

## Hospital Based Observational Assessment of Carrying Angle Changes Following Supracondylar Humeral Fractures in Children

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### Abstract

**Aim:** The aim of the study was to evaluate the functional outcome of carrying angle changes following supracondylar humeral fractures in children.

**Methods:** The present study was conducted in the Department of Orthopaedic for one year and 100 patients were included in the study.

**Results:** A total of 100 patients with a mean age of 5.2 years (SD± 2.3) were seen. 75% were male and 60% were less than 5 years of age. Most of the injuries occurred at home (64%). A total of 72% of the patients were seen within 24 hours of the injury. There was a significant difference in mean scores of PedsQL (all P values < .01) at 6 months. In the present study, pin site infection complication was seen in 5 patients.

**Conclusion:** In this prospective study, the quality of life of patients following SCHF diminished at the time of the injury and returned to the population normal 6 months after. There was no significant difference in HRQoL scores between patients who presented early and those who presented late. The delayed presentation and management did not also affect the functional outcome and complications.

**Keywords:** Flynn Criteria, Outcome, PedsQL, Supracondylar Humeral Fracture.

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### Introduction

Fractures around the elbow constitute one in three paediatric fractures. [1] The incidence of paediatric fractures involving the elbow is increasing. [2] The narrow supracondylar region is at a risk of fracture due to the presence of the olecranon fossa posteriorly and the coronoid fossa anteriorly. Supracondylar fracture is a metaphyseal injury, almost exclusively seen in the immature skeleton, mostly in children under ten years. [3] Furthermore, ligamentous laxity with hyperextension of the elbow is common in the growing skeleton, focusing a bending force on the susceptible supracondylar area. [3] Following supracondylar fracture in children, residual deformity can remodel well if it is the sagittal plane. [3,4] It is important to achieve anatomical reduction in the coronal plane as residual deformity here is less likely to remodel. Forms of treatment for these fractures include casting, traction, open reduction, and closed reduction with percutaneous

pinning (CRPP). There is a trend towards operative fixation in all displaced fractures [5] usually with CRPP, the incidence of which increased fivefold between 1987 and 2010. [6,7] However, there is no consensus of opinion regarding the optimal treatment. [4,8]

Some authors, however, have found no variations among the sexes whereas others found higher incidence among girls. [9,10] The left hand (which usually is the non dominant hand) is mostly affected in most studies. [9-11] These fractures are classified using the Gartland classification, which also serves as a treatment guide. [12] Gartland types I and II a fractures may be managed non operatively whereas types IIb and III are treated operatively. [13-15] Closed reduction and percutaneous (CRPP) fixation using Kirschner wires (K-wires) is the operative treatment of choice. [16] Bahk et al., in 2008 devised a classification based on fracture patterns in the

coronal and sagittal plane and proposed pin configuration specific to fracture pattern. The Bahk classification is based on the angle the fracture line makes with the line perpendicular to the distal humerus axis. In the anteroposterior (AP) view this is described as “coronal obliquity” and in the lateral view as “sagittal obliquity”. Coronal obliquity  $>10^\circ$  (medial oblique and lateral oblique varieties) are associated with more comminutions and rotational malalignments. Sagittal obliquities  $>20^\circ$  (high sagittal) are associated with rotational mal-unions and associated with other injuries. [17]

The aim of the study was to evaluate the functional outcome of carrying angle changes following supracondylar humeral fractures in children.

### Materials and Methods

The present study was conducted in the Department of Orthopaedic, Jawahar Lal Nehru medical College & Hospital, Bhagalpur, Bihar, India for one year and 100 patients were included in the study.

### Inclusion and exclusion criteria

The inclusion criteria for this study were children up to the age of 13 years. Children who had SCHF that were over 3 weeks old were excluded.

### Study procedure

Patients with Gartland type I fractures did not need any form of manipulation, whereas those with type II a fractures had manipulation under anesthesia. The limb was then put in a well- padded long-arm splint with  $60^\circ$  to  $70^\circ$  of elbow flexion for 3 weeks. X-rays were obtained weekly to ensure the fracture remains reduced. The higher energy types are usually associated with gross deformity of the elbow. All cases of Gartland type IIb and type III were done using CRPP with the aid of an image intensifier. The limb was then splinted for 3 weeks after which time the k-wires were removed. The cross-pinning technique was mostly used for this study. None of these injuries needed open reduction and pinning and none of those managed nonsurgical redislocated.

### Results

**Table 1: Characteristics of patients**

Characteristics	Frequency	Percentage (%)
<b>Gender</b>		
Male	75	75
Female	25	25
<b>Age</b>		
Less than 5 years	60	60
More than 5 years	40	40
<b>Mode of transport</b>		
Public: (taxi, trotro)	65	65
Private cars	25	25
Walk-in	8	8
Ambulance	2	2
<b>Location where the injury occurred</b>		
Home	64	64
School	28	28
Recreational area	8	8
<b>Time injury occurred</b>		
Day (morning and afternoon) Night (evening and night)	34	34
<b>Injury to admission</b>		
Less than 24 hours	72	72
24 hours to 72 hours	10	10
4 hours to 14 days	18	18
<b>Injury to theatre</b>		
Less than 24 hours	34	34
24 hours to 72 hours	10	10
4 hours to 14 days	56	56

A total of 100 patients with a mean age of 5.2 years (SD $\pm$  2.3) were seen. 75% were male and 60% were less than 5 years of age. Most of the injuries occurred at home (64%). A total of 72% of the patients were seen within 24 hours of the injury.

**Table 2: Complications observed during the study period**

Complications	N
Pin site infection	5
Gartland type II	2
Gartland type III	3
Nerve injury	4
AIN	2
Ulna nerve	1
Vascular injury	1
Cubitus varus	1
Myositis ossificans	1

In the present study, pin site infection complication was seen in 5 patients.

### Discussion

Supracondylar humeral fractures (SCHF) are the most common pediatric elbow fractures. [20-22] The reported incidence is between 50% and 70% of elbow fractures [23] and about 13% of all pediatric fractures. [24] The peak incidence is between the ages of 5 to 7 years with a male-to-female ratio of 2:1. [25,26]

A total of 100 patients with a mean age of 5.2 years (SD± 2.3) were seen. 75% were male and 60% were less than 5 years of age. Most of the injuries occurred at home (64%). A total of 72% of the patients were seen within 24 hours of the injury. The type II fractures in our series, whether managed surgically or nonsurgically, all resulted in satisfactory outcomes. This was because we applied the right treatment protocols depending on the fracture type (manipulation and splinting for type IIa and CRPP for type IIb). Miranda et al [27] made the same observations as they reported similar radiological and functional outcomes when closed reduction followed by casting was compared to CRPP of type II fractures. Again, 77% of type II fractures in the series by Hadlow et al [28] would have had unnecessary surgery if all of these fractures were surgically treated. Moraleda et al [29] also reported a good outcome (80.4%) in a series of 46 patients managed nonsurgically for type II fractures with a mean follow-up of 6.6 years.

There was a significant difference in mean scores of PedsQL (all P values < .01) at 6 months. In the present study, pin site infection complication was seen in 5 patients. Our results suggests that all the components of the PedsQL were affected by the injury initially but improved to near the population normal at 6 months' follow-up. This may be explained by the fact that it took about 3 to 4 weeks for the fracture to heal clinically and subsequent use of the affected limb with full return to activities of daily living. According to Michelson et al [30] by ages 5 to 6 years, most children would have enrolled into schools compared with those younger than this age. This age is also associated with

increased activity levels, minimal supervision by parents, increased playground activity both at school and home, all of which increases the risk of sustaining fractures. [31,32]

The role of home environment cannot be over-emphasized as 64% of the SCHF in our study occurred at home and this is similar to that found by Mangwani et al. [33] This may be because most of the patients from this study were restricted to play at home mostly because of safety reasons or lack of availability of sports facilities in the areas. Of these fractures, 66% occurred during the daytime, which unsurprisingly coincides with the period of maximum activity, and less supervision as the parents may not be home or the child may be in school. In this study, we fixed the fractures with 2 crossed pins. The crossing of pins at the fracture site may be associated with secondary displacement of the fracture and this might have accounted for the single incidence of cubitus varus seen. This was not serious enough to warrant surgical correction. Research has shown that cross pinning provides much stability compared with lateral or parallel pinning thereby reducing the incidence of cubitus varus which may result from displacement of the distal fragment or post treatment loss of reduction. [34,35] There was a single case of vascular injury that resolved after CRPP as well as a case of myositis ossificans, which resolved within a year of the injury. There were however no cases of compartment syndrome or Volkmann ischemic contractures, same as reported by other authors. [36]

### Conclusion

In this prospective study, the quality of life of patients following SCHF diminished at the time of the injury and returned to the population normal 6 months after. There was no significant difference in HRQoL scores between patients who presented early and those who presented late. The delayed presentation and management did not also affect the functional outcome and complications. Therefore, in a lower or lower middle income country surgical management of these injuries after late presentation is still safe.

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